

LOW CARBON LIVING
CRC

ANNUAL REPORT HIGHLIGHTS 2014-15



Australian Government
Department of Industry,
Innovation and Science

Business
Cooperative Research
Centres Programme



LOW CARBON LIVING CRC

2014/15 PARTICIPANTS





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Renovation to achieve a high performance workspace at 50 Martin Place, Sydney
by CRCLCL participant Brookfield Multiplex Photographer: Richard Drew



The Cooperative Research Centre for Low Carbon Living (CRCLCL) is a national research and innovation hub with a vital objective: to drive Australia's built environment sector towards a globally competitive low carbon future.

The CRCLCL engages a wide range of industry and government partners, fosters collaboration and supports outstanding research that is designed to meet the needs of end-users.

The CRCLCL will deliver:

- A more efficient and productive built environment sector as a whole
- Engaged communities taking action to reduce carbon emissions in their homes, suburbs and cities
- An evidence base for good planning and policy
- Large-scale national capability development
- Tools, technologies and techniques that will ensure the sector remains globally competitive

The CRCLCL is approaching the mid-point of its seven-year term with more than 70 research projects approved, 18 of which have been completed. Many of these projects are already developing next-generation low carbon materials and technologies, and are guiding government towards resilient, smart and sustainable cities of the future.

The CRCLCL plans to leave an important legacy in the form of greatly improved national capability for high-quality research, education and training in the built environment sector, and has established Nodes of Excellence at five Australian universities in order to achieve this.

The CRCLCL's mission is a vital one: to make low carbon living in Australia a reality. It is on track to achieve its goal of reducing CO₂ emissions by 10 megatonnes by 2020 and delivering economic benefits to the value of \$684 million by 2027.

MESSAGE FROM THE CHAIR

In its third year, the CRCLCL cemented its position as a national hub for research and innovation that will continue to generate social, economic and environmental benefits well beyond the organisation's period of tenure. The CRCLCL is realising its mission to lower carbon emissions in the Australian built environment and deliver competitive advantage for Australian industry.

The Board of Directors continued to guide the strategic direction of the CRCLCL, meeting five times in 2014-2015. The Board approved 14 new research projects, bringing to 71 the total number of projects approved to-date. It also commissioned an internal review of how the CRCLCL is tracking against its expected carbon reduction and economic benefits, with encouraging results.

The CRCLCL made impressive research progress in the past year, ably led by our CEO and Program Leadership Group. Many projects are reaching maturity and delivering outcomes for Australian industry and the broader community. I hope you will enjoy reading about some of our research highlights later in this report.

“ The CRCLCL remains committed to ensuring the ideas, interests, concerns and needs of end-users are firmly embedded within its research agenda. ”

The CRCLCL also vigorously pursued its education and capacity-building commitments to help ensure an ongoing legacy and, during the year, appointed an Education Leader to its headquarters team to further drive enrolments and oversee all education-related activities.

Five Nodes of Excellence were established at Australian universities during the year, another major achievement for the CRCLCL. Each Node will focus on a distinct but complementary research strength in the low carbon built environment and undertake end-user driven research projects, vocational training programs and supervision of HDR students.

The CRCLCL further strengthened its collaboration with participants and the broader built environment sector in its third year. Board members met with key CRCLCL participants to reinforce connections at the high levels of these organisations. With 45 active participants across research, government and industry, the CRCLCL remains committed to ensuring the ideas, interests, concerns and needs of end-users are firmly embedded within its research agenda.

There were some changes to Board membership during the year. Mr Tim Horton retired at the Annual General Meeting in November 2014 and did not stand for re-election. The CRCLCL Board welcomed two new members in 2014-15: Ms Megan Antcliff, our new Government Sector Director from the South Australian Government, and Professor Matthew Bailes, our new Research Sector Director from Swinburne University of Technology.

Finally, and with great sadness, I acknowledge the absence of our friend and colleague Professor George Collins, who passed away suddenly and unexpectedly on 14 November 2014. George was a highly valued member of the CRCLCL Board, generously sharing his insights, knowledge and experience. Translating research into world-changing industrial practice was George's passion, and we miss him greatly.

Thank you to everyone involved with the activities of CRCLCL over the past year. Together, we are raising awareness about the importance of the built environment to Australia's low carbon future and providing strategies and tools that will enable action. I am proud of our association and our achievements, and look forward to another year of impressive collaboration and results.



A handwritten signature in black ink that reads "Robert Hill". The signature is written in a cursive, slightly slanted style.

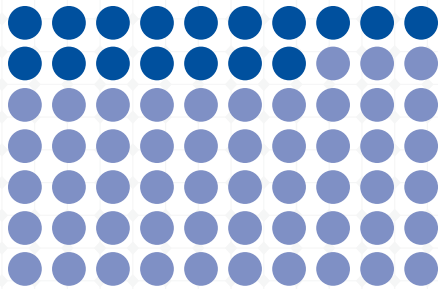
The Hon Robert Hill AC
Chair, Board of Directors

HIGHLIGHTS



71 APPROVED PROJECTS TO DATE

● 18 COMPLETED 53 ACTIVE



\$684m

expected benefit to Australian economy by 2027



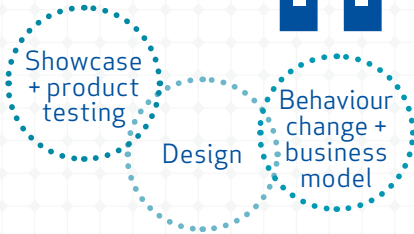
85 TOTAL MILESTONES DUE TO DATE

includes 15 utilisation milestones



8 IMPACT PATHWAYS

11 LIVING LABORATORY PROJECTS



ENABLING SIGNIFICANT CARBON REDUCTIONS

10Mt target by 2020

= The emissions from 2.1 million cars in a year



45 PARTICIPANTS

20 Industry
17 Government
8 Research



17

PROJECTS IN COMMERCIALISATION/UTILISATION STAGES



ONCE IN A GENERATION

CAPACITY BUILDING FOR THE BUILT ENVIRONMENT SECTOR

HDRs ENROLLED

61 OUT OF **88**



FORECAST INVESTMENT

\$9m

in student scholarships over life of CRCLCL



PREPARING INDUSTRY-READY GRADUATES

MESSAGE FROM THE CEO

The CRCLCL is approaching its mid-point after three years of operation and we are proud to reflect upon its achievements so far. The CRCLCL has met or is nearing all its scheduled research and utilisation milestones, and many of its projects are entering the utilisation phase.

The CRCLCL has continued to take an integrated approach to research. This approach relies on collaboration between multiple research organisations, end-users and industry groups. Research was carried out under the CRCLCL's eight Impact Pathways which are the focus of its work towards a low carbon future.

This report summarises the key research achievements for each Impact Pathway in year three, but I would like to point out some particular highlights:

- The photovoltaic/thermal (PVT) collectors project with BlueScope entered a pilot phase for its first-generation PVT roofing system.
- A new project commenced with the aim of integrating the BlueScope PVT roofing system with desiccant cooling systems.
- A world-first technical standard was devised to address the barriers confronting product development and industry uptake of renewable heating and cooling technologies.
- The geopolymer concrete project commenced laboratory and field trials, and development began on a world-first technical handbook for the use of geopolymer concrete in the design, specification and construction of structures.
- The Livewell Cluster project recruited its first tranche of 'decarb groups'; community-based groups who meet and support each other to take practical steps to reduce their carbon emissions.
- The Precinct Information Modelling (PIM) project developed databases for other CRCLCL projects, including the Broadway living laboratory, Tonsley (a living laboratory in Adelaide) and the Fishermans Bend urban renewal site in inner Melbourne.
- A framework for government low carbon living policy and program development is being finalised. Sustainability Victoria and the NSW Office of Environment and Heritage have already used an early iteration of the framework to better understand the impact of policy on carbon reductions.

Education and capacity building are of vital importance to the CRCLCL's long-term legacy. In 2014–15, the CRCLCL established research Nodes of Excellence at Curtin University, Swinburne University of Technology, the University of South Australia, the University of New South Wales and the University of Melbourne. Each Node will focus on a specific aspect of low carbon living research and, in addition to driving capacity building initiatives, will engage a greater number of partners through increased outreach and collaboration.

The Nodes will also undertake supervision of higher degree by research (HDR) students. In the past year, the CRCLCL increased its focus on student enrollments and is on track to exceed its target number of PhD graduates, with 61 HDR students now enrolled.

“ Our research has gained traction with stakeholders across Australia and we can be proud of the role we are playing in terms of raising awareness and driving policy change. ”

The CRCLCL's commitment to communication and information exchange saw increased activity in both these areas during year three. In addition to participating in a large number of seminars, conferences and workshops, the CRCLCL delivered more than 223 publications, including journal articles, project reports and media announcements. The Participants Annual Forum, held in November 2014, brought together CRCLCL partners and students to network and workshop new research, innovations and directions in low carbon living. The CRCLCL commenced a series of national forums and roadshows that will showcase exemplar projects to key groups and explore opportunities for sector-wide transformation.

Overall, it has been a fantastic year for the CRCLCL. Our research has gained traction with stakeholders across Australia and we can be proud of the role we are playing in terms of raising awareness and driving policy change. We are also proud to have increased community and industry understanding of low carbon technologies and the exciting possibilities of a low carbon future. I look forward to the rest of the journey.



Scientia Professor Deo Prasad AO
Chief Executive Officer

RESEARCH ACTIVITIES

The CRCLCL's research projects are organised under three Programs and eight Impact Pathways, which together set out a strategy for achieving a low carbon, economically viable built environment.

Program 1 Integrated Building Systems

Developing new low carbon embodied products and services, and finding ways to communicate best practice design through rating tools, standards and display homes.

PROGRAM LEADER



Assoc. Prof. Alistair Sproul

RESEARCH LEADER



Prof. Wasim Saman

Program 2 Low Carbon Precincts

Creating planning techniques and data for delivering low carbon developments at a precinct level. Communicating best practice in sustainable city planning through exemplar precinct developments and tools.



Prof. John Boland



Prof. Peter Newton

Program 3 Engaged Communities

Capturing a new community appetite for low carbon living. Through research, communicating to business and government the vision of a prosperous, liveable and sustainable society.



Dr Stephen White



Assoc. Prof. Catherine Bridge



Integrated Building Systems

1 Harnessing the Australian sun

2 Lowering the embodied carbon in buildings

3 Mainstreaming low carbon buildings



Low Carbon Precincts

4 Designing integrated low carbon precincts

7 Living laboratories as low carbon lifestyle narratives



Engaged Communities

5 Evidence base for low carbon living policy

6 Enhancing community engagement

8 Enhance education and capacity building

The following pages provide research project highlights for each impact pathway from year 3.

HARNESSING THE AUSTRALIAN SUN

There is enough sun landing on our roofs to power our cities. Instead of being exploited, it is currently just overheating buildings and causing large airconditioning loads. The CRCLCL's research aims to make active solar roofing products the default solution in the built environment.

BLUESCOPE PVT ROOFING SYSTEM

The CRCLCL is part of a world-leading project with BlueScope which is supporting the commercial implementation of the world's first commercially viable integrated photovoltaic and thermal (PVT) system for buildings – a system whereby rooftop PVT panels not only generate electricity, but also heat and shade buildings. For the past year, the project has been conducting a field trial on a residential building in Glebe, Sydney, using monitoring equipment to understand the impact of environmental factors and household energy usage. A new project related to the BlueScope PVT system aims to integrate it with desiccant cooling. This would enable it to cool buildings on hot summer days using energy derived from collected heat that would otherwise go unused.

Research Project RP1001: Air handling solutions, integration approaches and building design considerations for PVT roofing

Research Project RP1015: Combining a building integrated PVT system with a low temperature desiccant cooler to drive affordable solar cooling



BlueScope PVT field trial in Glebe, Sydney

"The CRC for Low Carbon Living continues to be a valued open innovation partner of BlueScope Steel. On a number of discrete projects, and more generally through the networks and relationships that the CRC facilitates, the CRC has demonstrated important and valued behaviours needed by industrial partners – responsiveness, versatility and openness. The CRC continues to produce quality insight and data that underpins key technology and commercialisation decisions of BlueScope."

MARK ECKERMANN
Product Innovation
Manager,
BlueScope Steel



WORLD'S FIRST TECHNICAL STANDARD FOR SOLAR HEATING AND COOLING

In order to increase industry uptake of renewable heating and cooling, it's important to remove barriers such as out-dated regulatory requirements and high costs. Standards Australia approved the development of the world's first technical standard for solar heating and cooling (AS5389) to be undertaken as part of a CRCLCL project. The technical standard provides a method for calculating energy savings from evaporative cooling, compared with the equivalent functionality from a conventional air conditioner. The methodology developed for this project will be incorporated into the NSW Energy Saving Scheme, which is used for awarding white certificates.

Research Project RP1008: Industry support mechanisms for renewable heating and cooling

AUTOMATED SOLAR ENERGY MANAGEMENT AND STORAGE

The CRCLCL is supporting Solar Analytics to develop intelligent algorithms that can better inform the management of energy storage and energy demand in residential and small commercial buildings. These algorithms take into account local load, weather and energy generation, and automatically analyse electricity production and consumption. This builds upon the work of a previous project that developed algorithms to model, monitor and diagnose the underperformance of photovoltaic systems. Solar Analytics used these algorithms in a performance analysis tool that has been launched commercially.

Research Project RP1023: Forecasting and home energy analysis in residential energy management solutions

Research Project RP1007: Intelligent automated monitoring of commercial photovoltaic (PV) systems

PARTICIPANTS

BlueScope Steel
CSIRO
CSR
NSW Office of Environment and Heritage
Standards Australia
Suntech R&D
University of New South Wales
University of South Australia



Solar Analytics Dashboard Image: Solar Analytics

“Standards Australia is collaborating with the CRCLCL on a number of projects where new standards are a recognised vehicle for better industry uptake. The CRCLCL also has enabled better international collaboration with groups like the International Energy Agency – such leadership from the CRCLCL is helping Australian industry to compete globally, and we are proud to be involved.”

JESSICA CURTIS
National Sector Manager,
Standards Australia



PATHWAY 2

INTEGRATED BUILDING SYSTEMS

LOWERING THE EMBODIED CARBON IN BUILDINGS

Significant energy and carbon is embodied in conventional building materials. The CRCLCL's research aims to increase the use of low carbon materials, ensuring they become mainstream.

OVERCOMING THE BARRIERS TO GEOPOLYMER CONCRETE

Geopolymer concrete (GPC) is made from industrial by-products, fly-ash and slag, and its carbon footprint is 80 per cent smaller than that of conventional Portland cement. An earlier CRCLCL study looked at the barriers and pathways to adoption of this material, and revealed the urgent need for updated technical standards and long-term performance data. The CRCLCL and Standards Australia are addressing this need by collecting and collating field data from real-life GPC constructions to develop a comprehensive GPC specification handbook. An on-site study is being undertaken at Brisbane West Wellcamp Airport and a pilot study has also been undertaken to evaluate prototype products.

Research Project RP1020: Reducing barriers for commercial adaptation of construction materials with low embodied carbon

USE OF WASTE MATERIALS IN PARTICLEBOARDS

The CRCLCL is investigating the use of waste materials – such as those from timber and agriculture or non-degradable plastics – as alternative fillers and binders for wood-based particleboards. The objective is to produce a sustainable alternative to conventional wood-based particleboard, with fewer associated emissions. Research has involved investigating processing conditions, and looking at the properties of these new, low carbon products compared with commercially available particleboards.

Research Project RP1022: Investigation of innovative sustainable low carbon products from waste materials for built environments

NEXT-GENERATION MEMBRANES TO PREVENT MOISTURE INGRESS

The CRCLCL is supporting Ametalin to develop next-generation membranes to prevent moisture ingress in construction. The project aims to develop a simple means of classifying the permeance of building membranes, as well as a moisture management handbook. Ametalin has developed two new products based on this work.

Research Project RP1012: Next generation low-emissivity pliable membranes for moisture management in building construction

PARTICIPANTS

AECOM
Ametalin
Ash Development Association of Australia
Aurecon
Australasian Slag Association
Standards Australia
Sydney Water
Swinburne University of Technology
University of New South Wales



In-situ assessment of Geopolymer concrete



Ametalin SILVERBRANE Reflective High Permeance Wall Wrap Photo: Ametalin

"The CRC has been invaluable to us, by creating an environment that promotes innovation; introducing new partners; and giving us access to key government decision-makers. This has helped us to develop a new line of patented products which we are now commercialising in Australia and abroad."

MICHEL BOSTRÖM
Managing Director,
Ametalin



PATHWAY 3

INTEGRATED BUILDING SYSTEMS

MAINSTREAMING LOW CARBON BUILDINGS

The CRCLCL is providing evidence of high performance in low carbon buildings to instil industry and consumer confidence, and drive adoption of low carbon buildings.

CSR LOW ENERGY HOUSE

The CRCLCL and CSR are using 140 sensors to produce a validated thermal model of the CSR Low Energy House. The house is a showcase for eight-star energy efficiency. It is located in Western Sydney and designed to raise awareness about low carbon building materials.

Research Project RP1010: Monitoring and modelling the CSR Low Energy House

ADVANCED COMFORT INDEX TOOL FOR HOMES

The CRCLCL is working on a project led by CSR to develop next-generation tools that highlight the thermal performance of buildings and the comfort and wellbeing of residents. This project, which is nearing completion, aims to drive uptake of low carbon homes by changing the conversation around their benefits.

Research Project RP1019: Advanced comfort index for residential homes

VALIDATING THE BUILDING SUSTAINABILITY INDEX (BASIX)

The CRCLCL is investigating the energy usage of new residential buildings in NSW to help identify ways to improve the building Sustainability Index (BASIX) assessment models; establish links between government regulations, design options and post-occupancy behaviour; and inform future sustainability strategies and policy. Government partners on this project include the NSW Department of Planning and Environment, the NSW Office of Environment and Heritage, the Australian Government Department of Industry, Innovation and Science, and the City of Sydney.

Research Project RP1017: Validating the NSW BASIX energy assessment tool for low carbon dwellings



BASIX project team



CSR Low Energy House

PARTICIPANTS

AECOM
Australian Institute of Architects
BlueScope Steel
Brookfield Multiplex
City of Sydney
Commonwealth Department of Industry, Innovation and Science
CSIRO
CSR
HASSELL
Nova Deko
NSW Department of Planning and Infrastructure
NSW Office of Environment and Heritage
Renewal SA
Victorian Building Authority
Curtin University
University of Melbourne
University of New South Wales
University of South Australia

“The NSW Department of Planning and Environment has been working with the CRC for Low Carbon Living on a project to validate the low carbon outcomes of residential buildings compliant with the Building Sustainability Index (BASIX) policy. My team is impressed by the ability of the CRC to engage experts in fields ranging from building science to social psychology to bring forward innovative solutions. What we appreciate most about working with the team at CRC is their commitment to engage the community (local councils, householders and building committees) for the project. Progress to date strongly suggests that the project will provide a solid evidence base to inform future sustainability strategies.”



DR KEVIN YEE Senior Technical Specialist, ePlanning, NSW Department of Planning and Environment

DESIGNING INTEGRATED LOW CARBON PRECINCTS

The CRCLCL's research is helping design low carbon neighbourhoods and built environments that support low carbon living. This includes not just individual buildings, but also transport, infrastructure, land use and waste management. Precinct design and assessment tools will drive the necessary functionality, provide data and scientific validation, and encourage broad government and industry acceptance.

PRECINCT INFORMATION MODELLING PLATFORM

The CRCLCL is developing an open platform for sharing precinct-scale information across all activities that lower carbon in the built environment. This platform will provide access to Precinct Information Models (PIMs), which are three-dimensional virtual models showing carbon performance within the landscape. PIM databases have been created for several precincts associated with CRCLCL research, including Lochiel Park in South Australia, Fishermans Bend in Melbourne and the Broadway precinct in Sydney. The tool was also demonstrated at the 2014 CRCLCL Participants Annual Forum.

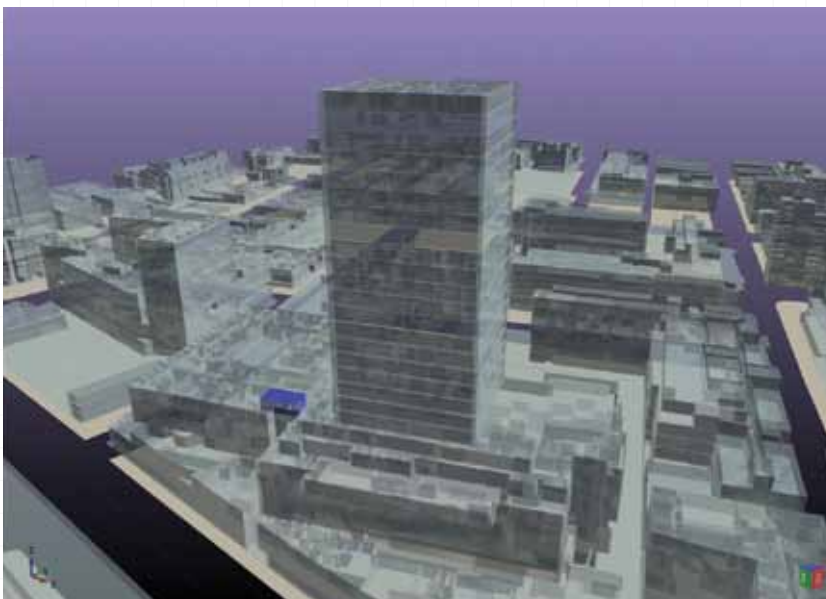
Research Project RP2011: Precinct Information Model (PIM): An open digital information standard throughout the urban development lifecycle

Research Project SP0001: Ideas for Fishermans Bend report

INTEGRATED CARBON METRICS

The CRCLCL has developed a prototype tool to track carbon through material and product production processes, and along supply chains. This data can be used to create spatial maps showing carbon flows. So far, the project has produced a carbon footprint map of Australia's five largest cities. The prototype Integrated Carbon Metrics (ICM) tool is being tested by project partners, and is being demonstrated to city councils and other potential end-users as part of CRCLCL roadshow events.

Research Project RP2007: Integrated Carbon Metrics: A multi-scale life cycle approach to assessing, mapping and tracking carbon outcomes for the built environment



Precinct Information Model of the Broadway precinct, Sydney

URBAN MICRO CLIMATES

The CRCLCL is examining the Urban Heat Island (UHI) effect in three Australian cities (Sydney, Melbourne and Adelaide) at the metropolitan, precinct and building levels. It aims to support decision making, planning and design by developing and communicating information relevant to greening buildings and public spaces in these cities.

Research Project RP2005: Urban micro climates: Comparative study of major contributors to the Urban Heat Island effect in three Australian cities (Sydney, Melbourne, Adelaide)

ENERGY, TRANSPORT, WASTE AND WATER FOR PRECINCTS

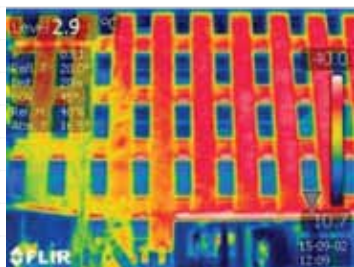
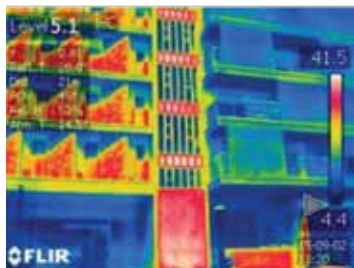
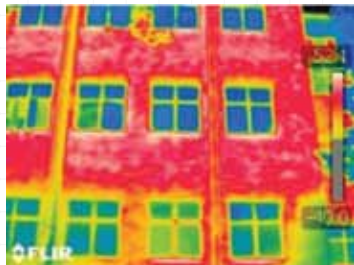
The CRCLCL is developing a shared platform for integrated ETWW (energy, transport, waste and water) demand forecasting and scenario planning. This tool will allow the overall carbon impacts of urban developments or redevelopments to be assessed effectively and efficiently.

Research Project RP2002: Integrated ETWW demand forecasting and scenario planning for precincts

LOW CARBON INCLUSIONS IN LAND DEVELOPMENT TENDERS

The CRCLCL is collaborating with industry and state governments to explore ways to reduce carbon in land development projects using tendering processes. UrbanGrowth NSW has successfully trialled a set of recommendations for including low carbon criteria in land development tenders.

Research Project RP2010: Informing and trialling low carbon inclusions in state government built environment sector tenders



Urban Micro Climates project infrared images of building facades

“I wish to acknowledge the value that the Victorian Building Authority is gaining from its involvement with the CRC for Low Carbon Living. Important, and timely research that bears directly on the Authority’s regulatory reform program is being undertaken by the CRC which would not otherwise have been initiated. These research projects cover pertinent areas such as development of building codes and performance standards; technological innovation in design and construction; capacity building for industry stakeholders; community engagement; and data management.”

ROBERT ENKER
Specialist Technical Advisor,
Victorian Building Authority



PARTICIPANTS

AECOM
Aurecon
BlueScope Steel
Brookfield Multiplex
BuildingSMART
Australasia
City of Melbourne
City of Sydney
Commonwealth
Department of Industry,
Innovation and Science
Commonwealth
Department of
Infrastructure and
Regional Development
CSIRO
HASSELL
Hunter Water
Infrastructure
Sustainability Council
of Australia
NSW Office of
Environment and
Heritage
Renewal SA
SA Department of
Environment, Water
and Natural Resources
SA Water
Sydney Water
UrbanGrowth NSW
Victorian Building
Authority
Curtin University
Swinburne University
of Technology
University of Melbourne
University of
New South Wales
University of
South Australia

PATHWAY 5

ENGAGED COMMUNITIES

EVIDENCE BASE FOR LOW CARBON LIVING POLICY

The CRCLCL is working with all levels of government to explore the social, environmental and financial benefits of low carbon policy actions. Providing evidence of these benefits will be a key factor in enabling government to implement policy change.

VISIONS AND PATHWAYS 2040

The CRCLCL is engaging with councils, government and industry stakeholders to distil a wide range of perspectives and develop visions for a low carbon built environment. Three 'brainstorming' sessions have been held to imagine and think about possible Australian cities of the future, with a focus on changes that might bring about radical carbon reductions. The results of these workshops have been translated into a series of images and narratives that are being used in meetings with partners and stakeholders to provide directions and ideas for change.

Research Project RP3008: Visions and Pathways 2040

ENERGY POLICY SCENARIOS

The CRCLCL has developed a unique approach for assessing the cost benefits of energy policies, initially focused on the commercial building sub-sector. Sustainability Victoria has already used the model to inform the design of a commercial building energy efficiency program. The model is also being used to help assess the impact of policy interventions and programs on building energy efficiency in retrofits. In addition, policy and design modelling work undertaken for the NSW Office of Environment and Heritage may feed into a legislative review in late 2015.

Research Project RP3002: A framework for low carbon living community policy and program development

PREDICTING FUTURE UPTAKE OF ENERGY EFFICIENT PRACTICES

The CRCLCL is developing a new Agent Based Modelling tool, aimed at predicting the uptake of low carbon and energy efficient technologies and practices by households and businesses, under different market interventions. The model will enable the NSW Government and other agencies to better understand, design and evaluate different types of market interventions (e.g. incentives, information, training, finance, codes).

Research Project RP3028: A "virtual market" for analysing the uptake of energy efficiency measures in residential and commercial sectors

PARTICIPANTS

AECOM
Aurecon
Brookfield Multiplex
City of Melbourne
City of Sydney
CSIRO
HASSELL
NSW Office of Environment and Heritage
SA Department of Environment Water and Natural Resources
Sydney Water
Swinburne University of Technology
University of Melbourne

BELOW LEFT
IMAGE CREDIT:
VEIL, Stephen Varady,
Marika Varady and
Tim Browne
BELOW IMAGE
CREDIT: VEIL,
Judith Glover,
Areli Avendano,
Stephanie Camarena
and Haeju Kwon

Visions for the future from Visions & Pathways 2040



PATHWAY 6

ENGAGED COMMUNITIES

ENHANCING COMMUNITY ENGAGEMENT

The CRCLCL aims to achieve productive collaboration between developers and communities that stimulates demand for low carbon infrastructure and services. CRCLCL research will develop community engagement/consultation processes and standards that facilitate rich dialogue about community aspirations for low carbon living.

PARTICIPANTS

BCI Media Group
BlueScope Steel
Brookfield Multiplex
City of Fremantle
CSIRO
NSW Office of Environment and Heritage
Curtin University
University of New South Wales
University of South Australia

LIVEWELL CLUSTERS

This living laboratory project promotes personal and community-based carbon reduction initiatives using "Livewell clusters", a new model of engagement that includes community groups, project groups and events. The first of these clusters was established in Melbourne's City of Yarra and is comprised of 'decarb' groups of participants who support each other to reduce their carbon footprints. The Livewell Yarra website (livewell.net.au) has been launched as an information resource and a calculation tool to help community members track their emissions reductions.

Research Project RP3011: Community carbon reduction and wellbeing enhancement

BLUE MOUNTAINS SUSTAINABLE TOURISM

A group of tourism providers in the Blue Mountains region has been auditing its carbon emissions to appeal to tourists who want to minimise their carbon footprint. An app-based marketing tool has also been developed, providing rewards to tourists who use the services of businesses that reduce their emissions. The project has strong local support. It has already engaged 29 businesses, which are collectively reducing their carbon emissions by 13 per cent.

Research Project RP3010: Building low carbon communities

COMMUNITY ENGAGEMENT IN URBAN DEVELOPMENT PLANNING

The CRCLCL has discovered that while there is a strong desire amongst councils to increase collaborative urban planning practices, a range of barriers (institutional, cultural and capacity related) are inhibiting uptake. Drawing on the knowledge of key stakeholders in the Australian urban development industry, this project will develop a community action tool/resources kit to be trialled in collaborative urban development planning pilot programs.

Research Project RP3019: Pathways to achieve low carbon living outcomes through collaborative urban development planning in Australia

BELOW LEFT:
The core Livewell team meeting at Carlton Library, January 2015

BELOW:
Blue Mountains sustainable tourism website



LIVING LABORATORIES AS LOW CARBON LIFESTYLE NARRATIVES

The CRCLCL's living laboratories will help create demand for low carbon living. Australians will adopt a low carbon lifestyle when they have positive experiences of its benefits and when they see others adopting and talking about it.



Central Park, Broadway Precinct, Sydney Photo: Frasers Property



WGV by LandCorp Images: Last Pixel



Tonsley, Adelaide Photo: Renewal SA, S. Noonan

11 LIVING LABORATORY PROJECTS



Showcase + product testing

Design

Behaviour change + business model

“One of the greatest barriers to innovation in Australia is the translation of the knowledge and technology outputs of our research sector into industry application for value creation. The CRC for Low Carbon Living is working with industry, government and research partners to underpin the innovation performance of the built environment sector in Australia. It does this through developing standards, co-developing technologies, creating tools, and building evidence to assist decision making and the results are flowing quickly from research to industry application to the benefit of partner organisations and the broader sector alike. I commend the CRC in particular on the commitment to living laboratories as a vehicle to ensure research is tailored to end-user applications, that early stage researchers are exposed to industry drivers and that community education and outreach is integral to all research activity.”

MEGAN ANTCLIFF
Director, Technology and Creative Industries and Director, Tonsley Redevelopment, South Australian Investment Attraction Agency



VALUING LOW CARBON HOMES AT POINT OF SALE

By exploring the effectiveness of different communications strategies at point of sale and lease, the CRCLCL seeks to empower consumers to recognise and value energy efficient homes that offer better health and comfort, and lead to sustainability benefits and lower running costs. The project is strongly influencing the development of the ASBEC Sustainable Housing Task Group's policy on how to improve the environmental sustainability of Australia's housing stock, using rating systems.

Research Project RP3016: The EnergyFit homes initiative: Enhancing the market for low carbon homes at point of sale

SOCIAL MEDIA CONVERSATIONS

The CRCLCL is exploring the use of both broadcast and social media as platforms to build conversations between CRCLCL researchers and the public around sustainable housing. This will facilitate researcher engagement with CRCLCL living laboratories and the broader Australian community.

Research Project RP3029: Driving a national social media conversation on energy efficient housing

JOSH'S HOUSE

Josh's House is a 10-star energy efficiency rating showcase residence occupied by Josh Byrne of ABC's Gardening Australia program. The CRCLCL is involved in a project communicating the journey, with a view to generating community interest. This project has an approximate reach of 26 million through website visits, online videos, eNews, Facebook, television, print media, radio, events and digital media.

Research Project RP3009: High performance housing: Monitoring, evaluating and communicating the journey (Josh's House)

PARTICIPANTS

Australian Window Association
BlueScope Steel
Centre for Liveability Real Estate
City of Fremantle
CSIRO
CSR
HASSELL
Housing Industry Association
Master Builders Association
NSW Office of Environment and Heritage
Renewal SA
SA Department of Environment, Water and Natural Resources
SA Water
TAFE NSW Sydney Institute
Curtin University
Swinburne University of Technology
University of Melbourne
University of New South Wales
University of South Australia



Josh's House Photo: Josh Byrne & Associates

ENHANCED EDUCATION AND CAPACITY BUILDING

It's essential the CRCLCL leaves a legacy that will help drive the widespread adoption of sustainable living practices over the coming years. To do so, it must inspire the next generation of researchers, built environment specialists and communities through education, training and capacity building initiatives.

HIGHER DEGREE RESEARCH (HDR) STUDENTS

The CRCLCL has identified and approved all of the required of 88 HDR student places. Currently there are 61 students (55 PhD and six Masters) enrolled across Swinburne University of Technology, Curtin University, University of South Australia, University of Melbourne and the University of New South Wales. These students are actively contributing to the CRCLCL's research projects.

TOWARDS EFFECTIVE PROFESSIONAL DEVELOPMENT IN LOW CARBON LIVING

The CRCLCL is investigating policy impediments to and incentives for effective education and training to support low carbon living. The outcomes will guide future professional development projects in the low carbon built environment, to be aimed at a wide range of stakeholders and end-users.

Research project RP3022: Policy impediments and incentives for effective education and training in low carbon living

HDRs
ENROLLED

61
out
of
88



FORECAST
INVESTMENT

\$9m
in student
scholarships over
life of CRCLCL

PREPARING
INDUSTRY-READY
GRADUATES



NODES OF EXCELLENCE AND THE CRC FOR LOW CARBON LIVING'S LEGACY

The CRCLCL has established Nodes of Excellence at five universities to provide a platform for ongoing capacity building and education, and ensure the CRCLCL's achievements continue to yield benefits well beyond its seven-year term. The Nodes are charged with undertaking end-user driven research projects, running vocational training programs and supervising HDR students. Each Node focuses on a distinct but complementary research strength in the low carbon built environment.

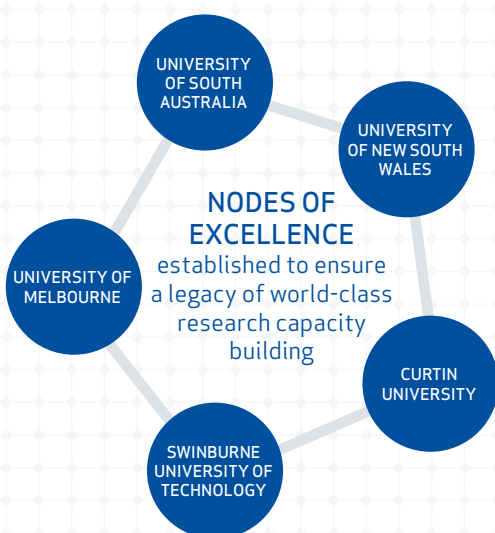
- + UNIVERSITY OF MELBOURNE: Urban visions, roadmaps, transitions
- + UNIVERSITY OF SOUTH AUSTRALIA: Urban renewal – integrated planning, transport, systems with living laboratories
- + UNIVERSITY OF NEW SOUTH WALES: Building systems, materials and integration, infrastructure scale focus – high performance architecture
- + CURTIN UNIVERSITY: Productive cities – social behaviour change, psychology, performance, productivity
- + SWINBURNE UNIVERSITY OF TECHNOLOGY: Low carbon urban retrofitting

PARTICIPANTS

- Centre for Liveability Real Estate
- CSIRO
- Master Builders Association
- Sydney Coastal Councils Group
- Victorian Building Authority
- TAFE NSW Sydney Institute
- Curtin University
- University of Melbourne
- Swinburne University of Technology
- University of New South Wales
- University of South Australia



Launch of the University of South Australia Node of Excellence held at Lochiel Park, May 2015



“Improved capacity building, education and training are integral to the CRCLCL’s vision for a globally competitive Australian built environment sector. The CRCLCL is an opportunity to work at a national level, providing targeted education and training programs to meet stakeholder needs. This capacity building is on an unprecedented scale and will position Australia to be amongst the world leaders in sustainability and zero carbon living.”

EMERITUS PROFESSOR DENNY MCGEORGE
 CRC for Low Carbon Living
 Education Leader



INDUSTRY NETWORK

The CRCLCL's Industry Network represents the interests and needs of small and medium enterprises (SMEs), which make up a large proportion of the low carbon industry. Formerly known as the SME & Peak Body Network, the Industry Network formally connects SMEs with relevant peak bodies and industry associations to promote information sharing and engagement.

Organisations connected to the Industry Network, whether official participants or not, play a significant role in driving the research agenda and helping to disseminate research outcomes to the broader community. They are also invited to participate in projects.

The Industry Network met approximately quarterly in year 3. A series of one-on-one meetings and a workshop were also conducted to discuss strategies to enhance communication and Network engagement with research activities and outcomes. A workshop in March 2015 focused on the needs of SMEs operating in a globally competitive low carbon environment, and how research can underpin competitiveness.

SMES

Aurecon Australia, BCI Media Group, HASSELL, Zimmerland

PEAK BODIES

Australian Institute of Architects, Australian Sustainable Built Environment Council, Green Building Council of Australia, Consult Australia, Housing Industry Association, Standards Australia

INDUSTRY ASSOCIATIONS

Ash Development Association of Australia, Australasian Slag Association, Australian Window Association, BuildingSMART Australasia, Master Builders Australia, Planning Institute Australia

"The CRC for Low Carbon Living's Industry Network includes a broad representation of industry players and provides participants with information on project statistics, project pipelines and other relevant information, and also acts as a key platform for ideas for future research projects generated by industry participants. It gives industry players and SMEs direct access to innovation and capacity building, providing them with competitive advantage as a sector. The Network is proving to be a vital and engaging forum enhancing the capability and value of the CRCLCL, with the potential to continue beyond the life of the CRCLCL into the future Nodes."



PROFESSOR KEN MAHER
ASBEC President, CRC for Low Carbon Living Industry Network Leader





Living laboratory:
Bowden, Adelaide
Photo: Renewal SA



**Living laboratory:
Lochiel Park, Adelaide**
Photo: Renewal SA

COLLABORATION

Collaboration is central to the operation and success of the CRCLCL, enabling it to tackle challenges and conduct research across a broad range of disciplines. The promotion of strategic collaboration between as many participants as possible, across the three key sectors of research, industry and government, is a primary ongoing focus.

END-USER DRIVEN APPROACH

In year 3, the CRCLCL made progress on or completed 61 research projects. Each project involved at least one research organisation and at least one end-user from either government, industry or a peak body organisation, or made results available for the wider public good. This collaboration between researchers and end-users underpins the CRCLCL's philosophy. The largest collaboration (RP3016: Enhancing the market for low carbon homes at point of sale and lease) involves 13 participants spanning three states.

'Sandpit' workshops are being used to further draw out big ideas that can have a transformative impact on lowering carbon in the built environment and maximise potential for utilisation of CRCLCL research. Various forums, steering committees and the CRCLCL's Industry Network also provide opportunities for end-users to engage and collaborate with each other.

The CRCLCL commenced a series of roadshows in year 3 to showcase exemplar projects to government land organisations and cities around Australia, with the first held at the City of Sydney. The roadshows are intended to bring researchers and potential end-users together to identify opportunities for utilisation of research.

RESEARCH NETWORKS

The CRCLCL's broad base of expertise is one of its key strengths. The people and teams selected from the research sector are leaders in their fields and have been sourced from five universities, the CSIRO and the TAFE system. The CRCLCL is also able to engage leading researchers from other institutions – both local and international – through its Third Party Project Agreements and MoUs.

As a result, the majority of the projects approved in year 3 are being run across a number of research institutions. To help foster these collaborations, the CRCLCL hosted its first two-day research workshop in June 2015, bringing together project leaders across all programs to share tools, data, information and expertise.

The CRCLCL held its first national forum in year 3, inviting key government and industry stakeholders to explore ways to share international research knowledge within Australia and leverage value for Australian industry. Further forums are planned for 2015–16.

EXTERNAL COLLABORATIONS

The CRCLCL partnered with the CRC for Water Sensitive Cities (CRCWSC) to host the Sydney 2015 Cities of the Future Conference. It also embarked on a special project with the CRCWSC to explore the application of emerging CRC research ideas and international best practice to the Fishermans Bend urban renewal site in Melbourne.

In year 3 the CRCLCL partnered with the United Nations Environment Program (UNEP) to develop a Sustainable Cities and Communities Guideline. It also devised and launched a Global Green Universities Toolkit, which UNEP is promoting in all its member countries.

CRCLCL is exploring opportunities to collaborate with organisations in several Asian countries, including China, India and Malaysia. It has also been sharing research intelligence with its international partners, KTH in Sweden and Concordia in Canada, to enable it to benchmark its work and identify opportunities for further collaboration.

"The involvement of the Ash Development Association of Australia and the Australasian (iron & steel) Slag Association in the CRC for Low Carbon Living is critical. The CRCLCL brings together built environment experts to provide a central focus on addressing the need to transition to a low carbon future for buildings and cities. The CRCLCL is about doing together what we could not do alone, and we have demonstrated the success of this through our project to remove barriers to the uptake of low carbon geopolymer concrete. By developing standard specification and design guidelines and new standards for geopolymer concrete, this project can enable uptake and have a transformative effect on the industry."

CRAIG HEIDRICH
CEO, Ash Development Association of
Australia and Australasian
(iron & steel) Slag Association



COMMUNICATION

The CRCLCL places a high priority on effective communication and increased its communications activities in year 3. Its main communication goals are to capture and raise awareness of the achievements of CRCLCL research projects, to support and promote further collaboration and to transfer of knowledge to end-users. Communication also helps to build a sense of community among CRCLCL participants and other interested parties.

RAISING GENERAL AWARENESS ABOUT LOW CARBON LIVING

The CRCLCL has continued to demonstrate its commitment to raising awareness and educating external stakeholders across industry, government and the community about low carbon living. To this end, the CRCLCL further improved the functionality of its website, which is a key resource for external stakeholders and provides information about research achievements and events, as well as access to reports and publications. In addition, the CRCLCL's email newsletter was delivered quarterly in year 3 to an expanded database.

The CRCLCL continued to maintain a strong media presence, issuing 15 media releases about a range of achievements, milestones and outcomes. Over 70 mentions of the CRCLCL and its research were achieved across mainstream and industry publications, including Sustainability Matters, The Fifth Estate, Architecture and Design and several major newspapers. CRCLCL researchers have also been interviewed by radio stations including Melbourne's 3RRR and Sydney's ABC 702. The CRCLCL continues to maintain an active social media presence on Twitter, LinkedIn, YouTube and Vimeo.

SUPPORTING AND PROMOTING COLLABORATION

The Participants Annual Forum is one of the CRCLCL's primary platforms for collaboration and communication. Its year 3 forum was held at the Australian Maritime Museum in November 2014. The event brings together participants and other stakeholders to learn about and workshop new research, innovations and directions in the low carbon built environment sector.

The forum was attended by about 175 delegates and featured 60 speakers. There were keynote addresses from the Hon Greg Hunt MP, Federal Minister for the Environment; the Hon Rob Stokes MP, then NSW Minister for the Environment, Minister for Heritage and Assistant Minister for Planning; and Dr Matthias Berger from the Future Cities Laboratory in Singapore.


The CRCLCL also hosted or took part in close to 30 lectures, seminars, conferences and workshops – including a number of international events – which provided excellent opportunities for networking and collaboration. Electronic direct marketing and quarterly newsletters were also used to inform stakeholders about specific opportunities for collaboration.

TRANSFERRING KNOWLEDGE TO END-USERS

A great many projects began to yield outcomes in the CRCLCL's third year, resulting in a dramatic increase in the number of publications and reports aimed at transferring knowledge to end-users. A total of 90 journal articles and conference papers or presentations were published or presented, along with 40 research project reports and 93 media releases, blogs and newsletters. The CRCLCL's website provides access to most of these reports and publications for the benefit of all stakeholders.



2014 Participants Annual Forum



“The CRC for Low Carbon Living has enabled significant collaborations between key stakeholders, identifying and developing a much needed evidence base for high performance in buildings and precincts. As an essential partner in the CRCLCL, this helps us and the sector compete in a lower carbon world.”



DR DENNIS ELSE
Executive Director Safety and Sustainability, Brookfield Multiplex

Low carbon, high performance working environment at 700 Bourke St, Melbourne by CRCLCL participant Brookfield Multiplex Photo: Glenn Hester



Medibank Place, 720 Bourke St,
Melbourne by CRCLCL participant
HASSELL Photo: Earl Carter

OUR PEOPLE

BOARD



The Hon Robert Hill AC
Independent Chair;
Chair of Nominations
Committee; member of
Research Advisory
Committee



Sandy Hollway AO
Independent
Deputy Chair;
Chair of Audit & Risk
Committee



**Professor
Ken Maher**
Additional Director;
leads Industry
Network



**Professor
Matthew Bailes**
Research Sector
Director



Dr Kevin Cullen
Research Sector Director;
member of Nominations
Committee and
Audit & Risk Committee



Dr Dennis Else
Industry Sector Director;
Chair of Research
Advisory Committee



Mr Lester Partridge
Industry Sector Director;
member of Nominations
Committee



Ms Megan Antcliff
Government
Sector Director



Dr Kate Wilson
Government Sector Director;
member of Nominations
Committee and Research
Advisory Committee

INDUSTRY NETWORK

RESEARCH ADVISORY COMMITTEE

AUDIT & RISK COMMITTEE

NOMINATIONS COMMITTEE



**Scientia Professor
Deo Prasad AO**
CEO



Paul Hopkins
Business Manager and
Company Secretary



Tom Cole
Research Project
Manager



Chloe Woodgate
Communications
Manager



Ross Flemons
Accountant



Sara Fagir
Office Manager



**Emeritus Professor
Denny McGeorge**
Education Leader

PROGRAM AND NODE LEADERSHIP GROUP



University of
Queensland Global
Change Institute
by CRCLCL
participant
HASSELL
Photo:
Peter Bennetts

FINANCIAL OVERVIEW

The CRC for Low Carbon Living continued to maintain a healthy financial position in the 2014-15 reporting period, carrying forward unspent funds to use in its research in year four*. The financial statements for the CRC for Low Carbon Living Ltd have been independently audited by

HLB Mann Judd (NSW) Pty Ltd and submitted to ASIC and the Commonwealth CRC Programme. The Auditor's report contained no adverse, qualified or other matters of emphasis. Copies of the Annual Financial Report for the period ended 30 June 2015, are available on request.

RESOURCES RECEIVED

TOTAL CASH AND IN-KIND CONTRIBUTIONS BY PARTNERS & GOVERNMENT

\$22.46
MILLION

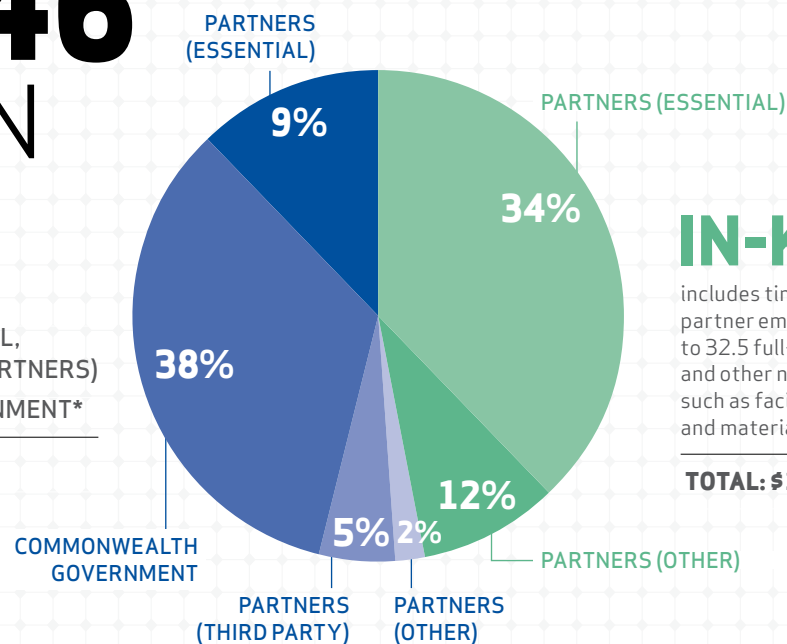
CASH

FROM TWO SOURCES:

1. CRC PARTNERS (ESSENTIAL, OTHER & THIRD-PARTY PARTNERS)
2. COMMONWEALTH GOVERNMENT*

TOTAL: \$12.08 MILLION

* Includes \$2.7m Commonwealth grant prepayment received in FY3 to be applied in FY4.



IN-KIND

includes time provided by partner employees (equivalent to 32.5 full-time researchers) and other non-staff resources such as facilities, equipment and materials

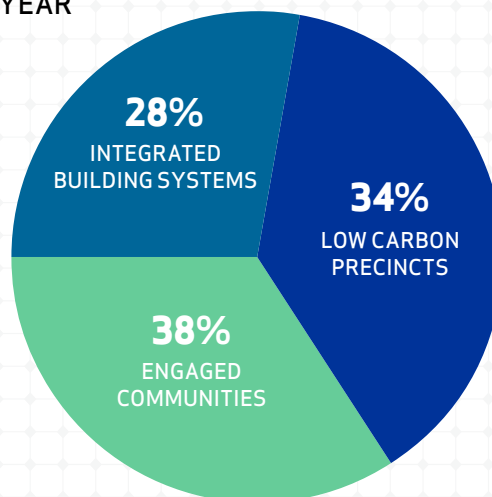
TOTAL: \$10.38 MILLION

RESOURCES APPLIED

RESOURCES APPLIED ACROSS THE THREE RESEARCH PROGRAM AREAS IN THE SECOND YEAR

\$18.21
MILLION

This includes proportions of expenditure on administration (\$1.46m) and education (\$1m), but no capital purchases were made.



YEAR 3 PROJECTS

NO.	IMPACT PATHWAY	PROJECT TITLE	PROJECT PARTICIPANTS	
PROGRAM 1 – INTEGRATED BUILDING SYSTEMS	RP1001	1. Harnessing Australian sun	Air handling solutions, integration approaches and building design considerations for Photovoltaic Thermal (PV-T) roofing	BlueScope; UNSW; UniSA
	RP1002	1. Harnessing Australian sun	Concentrated solar thermal systems and absorption HVAC systems	CSIRO; UNSW
	RP1008	1. Harnessing Australian sun	Industry support mechanisms for renewable heating and cooling	BlueScope; CSIRO; CSR; NSW OEH; SA Dept State Development; Seeley International; Standards Australia; UniSA; UNSW
	RP1009	3. Mainstream low carbon bldgs	Closing the Loop on evidence-based low carbon design of non-residential buildings	AECOM; Brookfield; Curtin; HASSELL; UniSA; UNSW; UoM; World Green Building Council
	RP1010	3. Mainstream low carbon bldgs	Monitoring and modelling the CSR Low Energy House	CSR; UniSA; UNSW
	RP1011	3. Mainstream low carbon bldgs	Sustainable and affordable living through modular, net zero energy, transportable, and self-reliant homes and communities	Nova Deko; UNSW
	RP1012	2. Low carbon materials	Next generation low-emissivity pliable membranes for moisture management in building construction	Ametalin; UNSW
	RP1013	3. Mainstream low carbon bldgs	Enabling better utilisation of distributed generation with distributed storage	UniSA; UNSW
	RP1014	3. Mainstream low carbon bldgs	Impact of energy efficient pool pumps on peak demand, energy costs and carbon reduction	Ausgrid; UNSW
	RP1015	1. Harnessing Australian sun	Combining a building integrated PVT system with a low temperature desiccant cooler to drive affordable solar cooling	BlueScope; CSIRO; UNSW
	RP1017	3. Mainstream low carbon bldgs	Validating and improving the BASIX energy assessment tool for low carbon dwellings	City of Sydney; DIIS; NSW DEPI; NSW OEH; UNSW
	RP1019	3. Mainstream low carbon bldgs	Advanced Comfort Index for residential homes	CSR; UNSW
	RP1020	2. Low carbon materials	Reducing barriers for commercial adaptation of construction materials with low-embodied-carbon	ADAA; AECOM; ASA; Aurecon; Australian Steel Mills Services; Engineered Material Services; Milliken Infrastructure Solutions; Roads and Maritime Services; Standards Australia; Swinburne; Sydney Water; UNSW; VicRoads; Wagners
	RP1021	3. Mainstream low carbon bldgs	Reframing building regulation: The role of building regulation as a policy instrument for the transition to low carbon built environment	Curtin; VBA
	RP1022	2. Low carbon materials	Investigation of innovative sustainable low carbon products for the built environment	UNSW
	RP1023	1. Harnessing Australian sun	Forecasting and home energy analysis in residential energy management solutions (Algorithms)	Solar Analytics; UNSW
	RP1024	3. Mainstream low carbon bldgs	Facilitating the transition to low carbon housing	AIA; Association of Building Sustainability Assessors; BlueScope; CSIRO; CSR; DIIS; Energy Inspection; Green Vision Developments; QUT; Renewal SA; Sustainability House; UNSW; UniSA; VBA
	RP1026	3. Mainstream low carbon bldgs	Evaluation of next-generation automated fault detection and diagnostic tools for commercial building energy efficiency	Brookfield; City of Sydney; Charter Hall; CSIRO; Lend Lease; Stockland
	PROGRAM 2 – LOW CARBON PRECINCTS	RP2002	4. Integrated low carbon precincts	Integrated ETWW demand forecasting and scenario planning for precincts
RP2003		4. Integrated low carbon precincts	A review of national and international low carbon precincts to identify pathways for mainstreaming sustainable urbanism in Australia	Curtin
RP2005		4. Integrated low carbon precincts	Urban Micro Climates: Comparative study of major contributions to the Urban Heat Island effect in three Australian cities (Sydney, Melbourne, Adelaide).	BlueScope; City of Adelaide; City of Melbourne; City of Sydney; HASSELL; Nursery & Garden Industry Australia; NSW OEH; Renewal SA; SA DEWNR; UniSA; UNSW; UoM
RP2006		7. Living laboratories	Action research to examine and demonstrate how to mainstream low-cost and low carbon housing in Western Australia	Balance Group; City of Freemantle; CSIRO; Curtin; Hickory; Landcorp; The Next Practice; WA Housing Authority
RP2007		4. Integrated low carbon precincts	Integrated Carbon Metrics (ICM) – a multi-scale life cycle approach to assessing, mapping and tracking carbon outcomes for the built environment	AECOM; Aurecon; BlueScope; CSIRO; Renewal SA; Swinburne; Sydney Water; UniSA; UNSW; UoM; UrbanGrowth NSW
RP2008		4. Integrated low carbon precincts	Beneficial reuse of solids from wastewater treatment operations	Degremont; Hunter Water; Prospect Water; SA Water; Suez Environment; Sydney Water; UniSA; UNSW
RP2010		4. Integrated low carbon precincts	Informing and trialling the inclusion of low carbon requirements in state government built environment sector tenders	Curtin; Sustainable Built Environment National Research Centre; Swinburne; UrbanGrowth NSW
RP2011		4. Integrated low carbon precincts	PIM: An open digital information standard for the exchange of precinct information supporting carbon management throughout the urban development lifecycle	Aurecon; Brookfield; BuildingSMART; ETH Singapore; UNSW; UoM
RP2014		4. Integrated low carbon precincts	Quantifying the contribution of green infrastructure to carbon and energy performance	Brookfield; ISCA; UNSW
RP2015		4. Integrated low carbon precincts	Carbon reductions and co-benefits: Literature and practice review of Australian policies relating urban planning and public health	UniSA
RP2017	4. Integrated low carbon precincts	Energy benchmarking for efficient, low carbon water recycling operations	SA Water; Sydney Water; UniSA; UNSW	
RP2017	4. Integrated low carbon precincts	Energy benchmarking for efficient, low carbon water recycling operations	SA Water; Sydney Water; UniSA; UNSW	

	NO.	IMPACT PATHWAY	PROJECT TITLE	PROJECT PARTICIPANTS
PROGRAM 2	RP2018	4. Integrated low carbon precincts	Retrofitting urban precincts to create low carbon communities – Broadway	AECOM; Brookfield; City of Sydney; Swinburne; TAFE Sydney; UNSW; UrbanGrowth NSW; UTS
	RP2019	4. Integrated low carbon precincts	Carbon reductions from composting food waste for food production – fitting recycling models to urban forms	City of Melbourne; Compost Victoria; Closed Loop Organics; East End Coordination Group (via City of Adelaide); Melbourne Metropolitan Waste Management Group; Moreland City Council; NAB; Nillumbik Council; RACV; Renewal SA; Sustainability Vic; Swinburne; UniSA; Veolia; Worm Lovers
PROGRAM 3 – ENGAGED COMMUNITIES	RP3001	5. Evidence base for LCL policy	Resource consumption and Household affordability; the changing nature of utility costs and the distributional implications	Swinburne
	RP3002	5. Evidence base for LCL policy	A framework for low carbon living community policy and program development	CSIRO; DIIS; NSW OEH; Sustainability Vic
	RP3007	6. Community engagement	Opportunities and challenges for the development and implementation of community-scale renewable energy projects	BCI Media Group; NSW OEH; UniSA; UNSW
	RP3008	5. Evidence base for LCL policy	Visions & Pathways 2040	AECOM; Aurecon; Brookfield; City of Melbourne; City of Sydney; HASSELL; SA DEWNR; Swinburne; Sydney Water; UoM; UNSW
	RP3009	7. Living laboratories	High performance housing: LL monitoring, evaluating and communicating (Josh's House)	Curtin; Josh Byrne & Associates; UniSA
	RP3010	6. Community engagement	Building low carbon communities	Blue Mountains City Council; Blue Mountains, Lithgow & Oberon Tourism; Blue Mountains World Heritage Institute; Curtin; Gridstone; NSW OEH; UNSW
	RP3011	7. Living laboratories	Community carbon reduction and wellbeing enhancement	Curtin; Yarra Council; Yarra Energy Foundation
	RP3012	7. Living laboratories	Transformation to low carbon living: Social psychology of low carbon behavioural practice	CSIRO; Swinburne; UoM
	RP3015	8. Education and capacity building	Increasing knowledge and motivating collaborative action on low carbon living through team-based and game-based mobile learning.	BuildingSMART; CLRE; Loud & Clear; MBA; SCCG; Swinburne; UoM; VBA
	RP3016	7. Living laboratories	Enhancing the market for low carbon homes at point of sale (Prog 1/3)	AGL; AWA; Clean Energy Council; CLRE; CSIRO; CSR; Energy Efficiency Council; Fletcher Insulation; Knauf Insulation; Low Energy Supplies & Services Pty Ltd; NSW OEH, Stockland; Swinburne
	RP3017	7. Living laboratories	Adelaide Living Laboratory Hub – Lochiel Park, Bowden and Tonsley	Adelaide City Council; Campbelltown Council; Charles Sturt Council; ENOLL; HASSELL; Marion Council; Renewal SA; SA Dept of State Development; SA DEWNR; SA Water; UniSA
	RP3019	6. Community engagement	Pathways to achieve low carbon living outcomes through collaborative urban development planning in Australia	Curtin
	RP3020	6. Community engagement	Carbon tools and frameworks for institutional precincts: Stage 1 – Low carbon schools scoping study	City of Fremantle; Curtin
	RP3021	7. Living laboratories	Media and communication strategies to achieve carbon reduction through renovation of Australia's existing housing	BlueScope; CSR; MBA; HIA; SA Dept of Manufacturing, Innovation, Trade, Resources & Energy; Sustainability Vic; Swinburne
	RP3022	8. Education and capacity building	Policy impediments and incentives for effective education and training in low carbon living	Swinburne
	RP3023	6. Community engagement	The contribution of community-owned renewable energy to regional development and resilience in the face of climate change	NSW OEH; UNSW
	RP3025	8. Education and capacity building	Sydney TAFE carbon reduction website	TAFE Sydney
	RP3028	5. Evidence base for LCL policy	A "virtual market" for analysing residential housing policy interventions	CSIRO; NSW OEH; Swinburne
	RP3029	6. Community engagement	Driving a national social media conversation on energy efficient housing – Stage 1	Australand; BlueScope; Brookfield; Collabforge; CSIRO; CSR; GBCA; KPMG; Lend Lease; NBNTV; NSW OEH; The Shannon Company
	RP3031	5. Evidence base for LCL policy	Information, risk and retrofit: Enabling energy/carbon disclosure at the building retrofit investor – user interface	Brookfield; Swinburne; UNSW; UoM
RP3033	7. Living laboratories	Mainstreaming low carbon housing precincts – the WGV living lab	City of Fremantle; Curtin; Josh Byrne & Associates; LandCorp	
SP0001	4. Integrated low carbon precincts	Fishermans Bend LL	CRC for Water Sensitive Cities	
SP0002	8. Education and capacity building	UNEP Green Unis Toolkit	UNEP	
SP0003	8. Education and capacity building	UNEP Beijing Guidelines for sustainable cities and communities	UNEP	
SP0004	8. Education and capacity building	ADB Skills Forum (Manila)	ADB	
SP0005	8. Education and capacity building	ADB Green Skills Forum (Washington DC)	ADB	
SP0006	3. Mainstream low carbon bldgs	Built environment impact framework and decision making tool	Brookfield; KPMG Banarra; UNSW	
SP0007	8. Education and capacity building	Carbon accounting assessment of CRCLCL projects	UNSW	

PARTICIPANTS INDEX

IMPACT PATHWAY

	1	2	3	4	5	6	7	8
AECOM Australia Pty Ltd (AECOM)		■	■	■	■			
Ametalin		■						
Ash Development Association of Australia (ADAA)		■						
Aurecon Australia Pty Ltd (Aurecon)		■		■	■			
Australasian Slag Association (ASA)		■						
Australian Institute of Architects (AIA)			■	■				
Australian Window Association Inc (AWA)							■	
BCI Media Group Pty Ltd (BCI Media Group)						■		
BlueScope Steel Limited (BlueScope)	■		■	■		■	■	
Brookfield Multiplex Constructions Pty Limited (Brookfield)			■	■	■	■		
BuildingSMART Australasia Incorporated (BuildingSMART)				■				
Centre for Liveability Real Estate (CLRE)							■	■
City of Fremantle						■	■	
City of Greater Geraldton				■				
City of Melbourne				■	■			
City of Sydney			■	■	■			
Commonwealth Department of Industry, Innovation and Science (DIID)			■	■				
Commonwealth Department of Infrastructure and Regional Development (DIRD)				■				
Concordia University, Canada, representing Smart Net-zero Energy Buildings Research Network (NSERC)				■				■
Consult Australia				■				
CSIRO	■		■	■	■	■	■	■
CSR Limited (CSR)	■		■				■	■
Curtin University (Curtin)			■	■		■	■	■
HASSELL			■	■	■		■	
Housing Industry Association Limited (HIA)							■	
Infrastructure Sustainability Council of Australia (ISCA)				■				
KTH, Royal Institute of Technology, Sweden				■				■
Master Builders Australia Limited (MBA)							■	■
Nova Deko Pty Ltd (Nova Deko)			■					
NSW Department of Planning and Infrastructure (NSW DEPI)			■					
NSW Office of Environment and Heritage (NSW OEH)	■		■	■	■	■	■	
Renewal SA			■				■	
SA Department of Environment, Water and Natural Resources (SA DEWNR)				■	■			
South Australia Water Corporation (SA Water)				■			■	
Standards Australia Limited	■	■						
Suntech R&D Australia Pty Ltd (Suntech R&D)	■							
Swinburne University of Technology (Swinburne)		■		■	■		■	■
Sydney Coastal Councils Group Inc. (SCCG)								■
Sydney Water Corporation (Sydney Water)		■		■	■			
TAFE NSW Sydney Institute (TAFE Sydney)							■	■
Tongji University, China				■				■
University of Melbourne (UoM)			■	■	■		■	■
University of New South Wales (UNSW)	■	■	■	■	■	■	■	■
University of South Australia (UniSA)	■		■	■		■	■	■
Victorian Building Authority (VBA)			■	■				■
United Nations Environment Program (UNEP)				■				■
UrbanGrowth NSW				■				



**LOW CARBON LIVING
CRC**

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